temperature over some other. For reasons above stated general meteorological features only can be presented in this brief reference.

In the second decade of December the barometric pressure was markedly high over east-central and central Europe, the 11th, 16th, and 17th being the only dates the area of high pressure was central west of the 20th meridian of east longitude. During this period the pressure rose above 30.30 and the temperature fell below —10° within the area of highest pressure. From the 19th to 24th the pressure was above 30.90 over northeast Russia, and on the 24th the temperature was below —20° in that region. On the 25th and 26th the pressure was above 31.10 in central Russia (the highest pressure noted in Europe during the period under discussion). During the last few days of the month the area of highest pressure occupied west-central Europe with pressure varying from 30.30 to 30.90. During this month the Asiatic area of high pressure seemed to have shifted its position to the westward, and the pressure was apparently below the normal over central Asia. During the third decade of the month the area of highest pressure shifted its position from east-central and central Europe to west-central Europe. The pressure for the month was above the normal over the south-central part of the United States, and it was below the normal over southeast and south-central Europe, over the north Atlantic Ocean along the trans-Atlantic steamship routes, over the Canadian Maritime Provinces, along the Atlantic coast of the United States, and over the northwest and extreme southwest parts of the United States. The European cold wave seemed to extend westward in the middle latitudes over the northeast part of the United States, while over the north-central part of the United States there was a marked excess of temperature.

During the early part of January the area of high pressure occupied a more southerly position than in December, and the pressure was high over the British Isles. On the 8th and 9th the pressure was above 30.70 over central Europe, and on the 10th the pressure was above 30.70 over southeast Europe, and an area of high pressure occupied west-central Europe. After the date last named the area of high pressure seemed to divide, one part receding into Asia, and the other showing an inclination to settle to the westward and southwestward over the British Isles. On the 14th and 15th the pressure was above 31.00 along the trans-Atlantic steamship routes east of the 25th meridian. During the latter part of January the mean pressure was generally low over the British Isles, and the area of high pressure was confined to east-central Europe, whence it extended over central Asia. In this month the mean pressure was below the normal over extreme southeast Europe, and generally over the United States and Canada east of the 100th meridian. The mean pressure was above the normal over the east part of the north Atlantic Ocean, between the 40th and 55th parallels, and over the west and extreme southeast parts of the United States; and in the middle plateau region the mean pressure was the highest ever noted in the United States for January. The mean temperature was the highest on record for January over the northwest part of the United States, and it was above the normal in parts of central Asia and southeast Europe. The European cold did not extend westward to the American continent, where the month was warmer than usual, except in the south-central and extreme southeast parts.

The following are among the lowest temperatures noted in western Europe during the past winter: —2° at Berlin, January 18th; —2° at Münich, January 17th; —2° at Vienna, December 30th; 0 at Stockholm, January 10th; 3° at Brussels, December 30th; 8° at Paris, January 20th; 14° at London, December 25th; 21° at Leith, January 8th; 30° at Lisbon, January 19th; and 28° at Algiers, January 19th. During the period of 41 days from December 13th to January 22d the minimum temperature fell below the freezing point on 41 days at Vienna, Münich, and Stockholm; on 40 days at London and Brussels; on 39 days at Berlin; on 37 days at Paris; on 25 days at Leith; on 6 days at Rome; on 2 days at Algiers; and on one day at Lisbon. Over the south part of England, where the mean temperature for December was more than 10° below the normal, the cold spell was reported the most persistent since 1814, although the temperature was not exceptionally low nor the snowfall remarkably heavy. Over the north part of the British Isles the mean temperature was above the normal. Over the west part of the continent of Europe the winter will number among the most severe of the century. In Austria the cold was unprecedented in a quarter of a century. The severer winters of the century in western Europe were those of 1807–1808, 1812–1813, 1813–1814, and 1829–1830, the last being the most severe. Other cold spells occurred in January, 1838, February, 1845, February, 1855, December, 1879, and January, 1881.

Among notable features of the past winter were the unusually small number of cold waves of marked severity which reached the Atlantic coast of the United States from the interior of the continent; the marked tendency of north Atlantic storms to pass southeastward over the Bay of Biscay, southeast Europe, and the Mediterranean Sea in December, to which course they were probably deflected by the area of high pressure over central Europe; and the northerly course of north Atlantic storms over the eastern part of the ocean in January, in which month the area of high pressure occupied a more southerly and westerly position than in December, and the storms were apparently deflected to a northerly course before reaching European waters. Referring to the period of cold in Europe, Mr. C. J. Lyons, in charge of the weather service of the Hawaiian Government Survey at Honolulu, reports that the characteristics of the winter at that place were the unusual persistence of trade winds and a tendency in variable winds to the northwest quadrant rather than the southwest quadrant, resulting in an enormous disproportion of rainfall on the northeast coasts and mountain sides. The barometric pressure was only about .006 above the normal, and the temperature very slightly in excess, owing to the prevalence of the trades.

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for January, 1891, as determined from the reports of nearly 2,000 stations, is exhibited on Chart III. In the table of Signal Service data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The heaviest precipitation occurred on the north Pacific coast, where 15.93 fell at Neah Bay, Wash. The monthly precipitation exceeded 10.00 in southeast Massachusetts, west Connecticut, southeast New York, north New Jersey, north-central Alabama, central and southwestern Mississippi, the interior of Louisiana and eastern Texas, and on the central Oregon coast; it exceeded 8.00 over central Nova Scotia, from southeast New York and east Pennsylvania over north New Jersey, north Connecticut, and a part of southeast Massachusetts, in north-central Alabama, from central Mississippi over east Texas, and on the central Oregon and extreme north Washington coasts. No precipitation was reported in the lower Colorado and lower Gila valleys and thence over southeast California to

about the 37th parallel, and less than 1.00 was reported in and south of the Sacramento Valley, Cal., generally over the middle and southern plateau regions, save in central Colorado and from north New Mexico to east-central Arizona, on the northeast and southeast slopes of the Rocky Mountains, from Lake Superior westward over Montana and southward in the Missouri Valley to Nebraska, in an area extending from northeast Indian Territory over Missouri to south-central Illinois, and in east-central Florida.

The monthly precipitation was irregularly distributed. It was in excess of the January average in the middle Atlantic and New England states, on the coast of southern North Carolina, in extreme south Florida, from the west Gulf states northeastward to Kentucky, northward west of the Mississippi River to the Red River of the North Valley, and northwestward over the east part of the middle and southern plateau regions. On the Pacific coast and thence over the west parts of the southern and middle plateau regions, and from the north Pacific coast eastward to the Red River of the North Valley, the precipitation was deficient. The greatest excess in precipitation occurred on the Maine coast and in the interior of the west Gulf states, where it exceeded 3.00, and the most marked deficiency was noted along the Pacific coast, where it was more than 2.00, and at San Francisco, Cal., the deficiency was 4.00.

Considered by districts the average percentage of the normal in districts where the precipitation was in excess was about as follows: middle-eastern slope of the Rocky Mountains, 294 per cent.; southeast slope of the Rocky Mountains, 220 per cent.; New England, 155 per cent.; west Gulf states, 164 per cent.; Missouri Valley, 144 per cent.; Rio Grande Valley, 142 per cent.; middle Atlantic states, 129 per cent.; northeast slope of the Rocky Mountains, 113 per cent.; east Gulf states, 105 per cent.; and upper lake region, 102 per cent. In districts where the precipitation was deficient the percentage of the normal was about as follows: middle Pacific coast, 21 per cent.; south Pacific coast, 37 per cent.; northern plateau, 45 per cent.; middle plateau, 59 per cent.; extreme northwest, 63 per cent.; north Pacific coast, 70 per cent.; south Atlantic states, 77 per cent.; lower lake region, 80 per cent.; southern plateau, 81 per cent.; Florida Peninsula, 91 per cent.; Ohio Valley and Tennessee, 98 per cent.; upper Mississippi valley, 99 per cent.

The heaviest precipitation ever noted for January occurred at Strafford, Vt., Portland and Orono, Me., Albany and Cooperstown, N. Y., Middletown, Conn., Amherst and Somerset, Mass., South Orange, N. J., Dyberry, Pa., Palestine and San Antonio, Tex., Marquette, Mich., Omaha, Nebr., and Cheyenne, Wyo., in 1891, when the departure above the normal varied from over 4.00 at Portland, San Antonio, and Palestine, to less than 2.00 at Omaha and Cheyenne; from east-central Missouri to central Ohio in 1890, when the excess was 2.00 to 7.00; in central and east Arizona in 1886, when the excess was 2.00 to 4.00; in north Louisiana in 1885, when the excess was more than 7.00 at Shreveport; on the North Carolina coast and in Colorado and southeast Wyoming in 1883, when the excess was 2.00 to 7.00 on the North Carolina coast, and more than 1.00 in Colorado; from the lower Mississippi valley northeastward to Maryland in 1882, when the excess was 7.00 to 8.00 in the lower Mississippi valley, 7.00 to 11.00 in Tennessee, and 2.00 to over 4.00 in Maryland and the District of Columbia; along the middle Pacific coast and on the South Carolina and southern North Carolina coasts in 1878, when the excess was 5.00 to 15.00 on the middle Pacific coast, and over 3.00 on the south Atlantic coast; in the middle and lower Ohio valley in 1876, when the excess was 6.00 to 11.00; and in the lower Missouri valley and thence over southeast Iowa in 1874, when the excess was over 2.00.

The least precipitation ever noted for January by Signal Service observers occurred at Detroit, Mich., Fort Assinniboine and Helena, Mont., Spokane Falls, Wash., and San Francisco, Cal., in 1891, when the departure below the normal varied from 4.00 at San Francisco to about 1.00 at Detroit, Fort Assinniboine, and Helena. At Yuma, Ariz., 16 years record, no precipitation was reported and no precipitation was noted at that station in January, 1878, 1881, and 1887. At Keeler, Cal., 6 years record, the current month was the first January for which precipitation has not been reported. The least precipitation for January occurred along the east Gulf coast and thence northeastward inside the Atlantic coast line to southeast Virginia in 1890, when the deficiency was 4.00 to 5.00 on the east Gulf coast, 3.00 to 4.00 in the south Atlantic states, and 2.85 at Norfolk, Va.; on the middle and north Pacific coasts and over the south part of the northern plateau in 1889, when the deficiency was 3.00 to 4.00 on the middle Pacific coast, 4.00 to 5.00 on the north Pacific coast, and 1.00 to 2.00 over the northern plateau; over the Florida Peninsula in 1888, when the deficiency was 2.00 to 3.00; from Texas and Indian Territory westward to the south Pacific coast, except in southeast Arizona, in 1887, when the deficiency was generally less than 1.00 in Texas and Indian Territory and over 2.00 on the south Pacific coast; from north Montana to northeast Washington in 1884, when the deficiency was about 1.00; in southeast Arizona and from north Louisiana to southwest Illinois in 1881, when the deficiency was 1.00 to nearly 3.00 in the Mississippi Valley and about 1.00 in southeast Arizona; from central Mississippi northeastward to east Tennessee in 1880, when the deficiency was 1.00 to over 3.00; from northeast Iowa to the southwest coast of Lake Michigan in 1879, when the deficiency was 1.00 to 2.00; along the south Atlantic and a part of the middle Atlantic coast in 1876, when the deficiency was 3.00 to 5.00; from the lower Missouri Valley over southeast Iowa and from west Tennessee north-northeast over south Pennsylvania, Maryland, and the District of Columbia in 1872, when the deficiency was 1.50 in southeast Iowa, and 2.50 to 3.50 from Tennessee to Maryland.

In 1890, when the precipitation was the heaviest ever noted for January from east-central Missouri to central Ohio, it was the least ever reported along the east Gulf coast and over the interior of the south Atlantic states; in January, 1876, when the precipitation was the heaviest reported for that month along the middle and lower Ohio River, it was the least ever noted for January along the south Atlantic and parts of the Virginia and New Jersey coasts.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for January for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for January, 1891; (4) the departure of the current month from the average; (5) and the extremes for January during the period of observation and the years of occurrence:

State and station.	County.	(1) Average for the month of Jan.	(2) Length of record.	(3) Total for Jan., 1891.	(4) Departure from average.	(5) Extremes for Jan.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Arkansas.		*Inches*	*Years*	*Inches*	*Inches.*	*Inches*		*Inches.*	
Lead Hill	Boone	3.11	9	2.25	−0.86	7.37	1890	1.33	1887
California.									
Sacramento	Sacramento	3.87	37	0.58	−3.29	15.04	1862	0.19	1889
Connecticut.									
Middletown	Middlesex	4.24	29	9.24	+5.00	9.24	1891	1.45	1876
Florida.									
Merritt's Island	Brevard	3.75	13	1.79	−1.96	10.45	1878	0.56	1890
Georgia.									
Forsyth	Monroe	5.11	17	7.88	+2.77	10.08	1883	2.22	1880
Illinois.									
Peoria	Peoria	1.73	33	1.68	−0.05	4.27	1862	0.20	1872
Riley	McHenry	1.97	40	2.22	+0.25	5.96	1876	0.45	•
Indiana.									
Logansport	Cass	2.18	16	1.67	−0.51	5.69	1890	0.23	1881
Vevay	Switzerland	4.13	24	4.21	+0.08	9.03	1876	0.75	1872
Iowa.									
Cresco	Howard	1.35	19	1.80	+0.45	3.72	1886	0.38	'72,'84
Monticello	Jones	1.66	36	1.25	−0.41	3.77	1886	0.29	1865
Logan	Harrison	1.27	22	1.79	+0.52	3.10	1881	0.10	1872
Kansas.									
Lawrence	Douglas	1.28	26	1.43	+0.15	3.05	1878	0.12	1875
Wellington	Sumner	0.93	12	1.95	+1.02	2.40	1890	0.18	1881

Deviations from average precipitation—Continued.

State and station.	County.	(1) Average for the month of Jan.	(2) Length of record.	(3) Total for Jan., 1891.	(4) Departure from average.	(5) Extremes for Jan.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Louisiana.		*Inches*	*Years*	*Inches*	*Inches.*	*Inches*		*Inches.*	
Grand Coteau	St. Landry ..	6.37	8	10.43	+4.06	13.30	1883	2.52	1887
Maine.									
Orono	Penobscot ...	4.58	21	7.66	+3.08	7.66	1891	2.00	1875
Maryland.									
Cumberland	Allegany	2.12	19	2.93	+0.81	3.90	1878	0.30	1887
Massachusetts.									
Amherst	Hampshire ..	3.34	55	8.17	+4.83	8.17	1891	0.99	1849
Newburyport	Essex	3.62	12	6.86	+3.24	7.76	1886	1.60	1875
Somerset	Bristol	4.32	18	8.94	+4.62	8.94	1891	1.57	1879
Michigan.									
Kalamazoo.....	Kalamazoo ..	2.42	15	1.56	−0.86	4.90	1876	1.10	1879
Thornville.....	Lapeer	2.07	14	1.14	−0.93	3.38	1890	0.58	1879
Minnesota.									
Minneapolis	Hennepin....	1.20	25	0.86	−0.34	3.01	1886	0.06	1869
Montana.									
Fort Shaw	Lewis&Clarke	0.60	20	0.35	−0.25	2.50	1881	0.00	1869
New Hampshire.									
Hanover	Grafton.....	2.90	46	4.52	+1.62	9.75	1851	0.31	1853
New Jersey.									
Moorestown	Burlington ..	3.45	27	5.07	+1.62	5.82	1882	1.13	1867
South Orange	Essex	4.07	19	10.55	+6.48	10.55	1891	1.17	1876
New York.									
Cooperstown.....	Otsego.....	2.48	37	5.54	+3.06	5.54	1891	0.32	1860
Palermo	Oswego.....	3.18	37	2.44	−0.74	6.50	1874	0.16	1884
North Carolina.									
Lenoir.....	Caldwell.....	4.38	19	5.60	+1.22	9.60	1878	1.10	1890
Ohio.									
N. Lewisburgh ..	Champaign ..	3.78	19	3.50	−0.28	8.67	1876	0.44	1877
Wauseon	Fulton	2.33	17	2.56	+0.23	4.14	1890	1.29	1879
Oregon.									
Albany	Linn.....	8.80	14	4.65	−4.15	14.45	1867	2.22	1882
Eola	Polk.....	6.12	21	4.99	−1.13	16.68	1888	2.53	1875
Pennsylvania.									
Dyberry	Wayne	3.20	21	5.30	+2.10	5.30	1891	0.70	1872
Grampian Hills ..	Clearfield....	3.76	20	3.62	−0.14	5.47	1888	1.21	1872
Wellsborough ...	Tioga.....	6.43	11	6.53	+0.10	12.17	1886	1.98	1890
South Carolina.									
Statesburgh	Sumter.....	3.54	9	2.90	−0.64	6.04	1885	0.90	1890
Tennessee.									
Austin	Wilson.....	5.55	22	5.93	+0.38	18.11	1882	2.66	1886
Texas.									
New Ulm	Austin	4.30	17	2.26	−2.04	10.56	1882	1.00	1887
Vermont.									
Strafford	Orange	3.50	17	6.10	+2.60	6.10	1891	1.70	1878
Virginia.									
Birdsnest.....	Northampton	3.66	22	6.00	+2.34	6.75	1882	1.00	1876
Washington.									
Fort Townsend..	Jefferson	2.19	20	2.91	+0.72	4.65	1890	0.66	1859
Wisconsin.									
Madison	Dane	1.93	25	1.19	−0.74	3.65	1874	0.40	1878

* 1865, 1867, and 1872.

EXCESSIVE PRECIPITATION.

Precipitation to equal or exceed 10.00 was reported at 11 stations in Louisiana, at 8 stations in Mississippi, at 4 stations in Texas, at 3 stations in Connecticut, at 2 stations in Washington, and at 1 station in Alabama, Massachusetts, New York, New Jersey, and Oregon; the greatest amount, 15.93, being noted at Neah Bay, Wash.

The heaviest precipitation for January commonly occurs in west Washington and Oregon and north California, where in the last 21 years it has failed to exceed 10.00 in 8 years in Washington, 1875 to 1878, 1881 to 1883, and 1889; in 8 years in Oregon, 1872, 1875, 1877 to 1879, 1882, 1884, and 1885; and in 6 years in California, 1873, 1883 to 1885, 1887, and 1889. Among the heavier January rainfalls reported in that region during the period named are: 30.50, at Neah Bay, Wash., in 1874; 22.16, at Astoria, Oregon, in 1871; and 41.63, at Upper Mattole, Cal., in 1888. For this period precipitation to equal or exceed 10.00 in January has been reported for 7 years in Ga., N. Y., and N. C.; for 6 years in Tenn.; for 5 years in Ala. and La.; for 4 years in Ark., Fla., and Tex.; for 3 years in Ind., Mass., and Miss.; for 2 years in Ill., Ohio, Pa., and Va.; and for 1 year in Conn., Iowa, Kans., Ky., Me., Md., Mo., Nev., N. H., and N. J. In Massachusetts the monthly precipitation exceeded 15.00 in 1874 and 1875; in Georgia in 1882 and 1883; in Illinois in 1876; in Indiana in 1884; in Louisiana in 1886; and in Tennessee in 1882.

Precipitation to equal or exceed 2.50 in 24 hours was reported at 18 stations in La., and on 10 dates, the 1st, 7th to 9th, 20th, 21st, 27th to 29th, and 31st; at 7 stations in Ark., on the 30th and 31st; at 7 stations in Mississippi, and on 5 dates, the 8th, 10th, 21st, 28th, and 29th; at 6 stations in Tenn., on the 30th and 31st; at 5 stations in Tex., and on 5 dates, the 7th, 8th, and 26th to 28th; at 4 stations in N. C., and on 4 dates, the 1st, 10–11th, and 21st; at 3 stations in N. Y., and on 3 dates, the 11–12th and 22d; at 2 stations in Ky., on the 31st; at 2 stations in Mass., and on 3 dates, the 17–18th and 19th; at 1 station in Conn. on the 11–12th; at 1 station in Iowa on the 1st; at 1 station in Me., on the 11–12th; at 1 station in N. J., on the 24–25th; at 1 station in Nebr., on the 27–28th; and at 1 station in N. J., on the 24–25th; at 1 station in Nebr., on the 27–28th; and at 1 station in Wash., on the 19th. Among the heavier rainfalls noted for this period are: 5.89, at Houston, Tex., 7–8th; 5.40, at Cheneyville, La., 29th; 5.00, at Jeanerette and Lake Charles, La., 8th; 4.56, at Covington (1), Ky., 30th–31st; and 4.40, at Kosciusko, Miss., 8th.

In the last 21 years precipitation to equal or exceed 2.50 in 24 hours in January has been reported for 12 years in La. and Tenn.; for 11 years in Ga.; for 10 years in N. C. and Tex.; for 8 years in Fla.; for 7 years in Miss., Oregon, and Va.; for 6 years in Cal. and Mass.; for 5 years in Ala., Ark., Ill., N. Y., Ohio, Pa., and Wash.; for 4 years in Ind. and S. C.; for 3 years in Ky., Mo., and N. J.; for 2 years in Conn., Ind. T., Md., and Mich.; and for 1 year in Del., Iowa, Me., N. H., and Wis. Among the heavier 24-hour rainfalls reported for this period are: 8.40, at Point Pleasant, La., 1st–2d, 1886; 7.00, at Emory Grove, Md., 30th, 1879; 6.45, at Huntsville, Tex., 2d, 1890; 6.38, at Jupiter, Fla., 11–12th, 1889; 6.32, at Lynchburgh, Va., 23d, 1885; 6.03, at Hepzibah, Ga., 19–20th, 1889; 6.00, at Fayette, Miss., 6th, 1883; 5.96, at Upper Mattole, Cal., 29th, 1890; 5.71, at Shreveport, La., 13th, 1885; 5.35, at Monroe, La., 2d, 1886; 5.20, at Fullerton, Ark., 1st, 1890. At Upper Mattole, Cal., 31.68 fell from the 27th to 31st, 1888.

Precipitation to equal or exceed 1.00 in 1 hour was reported at 1 station in Tex., on the 9th; at 1 station in N. C., on the 11th; and at 1 station in Tenn., on the 31st. Remarkably heavy rainfall in 1 hour was not reported for January, 1891, and excessive rainfall for 5 and 10 minute periods is given in the table of "Maximum rainfall in one hour or less."

In the last 21 years precipitation to equal or exceed 1.00 in January has been reported for 3 years in Illinois; and for 1 year in California, Florida, Georgia, and Texas. Among the heavier 1-hour rainfalls reported for this period in January are: 4.36 in 1 hour at Atwood, Ill., 1st, 1890; 1.60 in 1 hour, at Cairo, Ill., 17th, 1876; and 1.03, in 28 minutes, at Titusville, Fla., 4th, 1889.

Heavy rainfall at Saint Christopher's Island, W. I., in January, 1880.

Mr J. F. Flagg, Brooklyn, N. Y., has furnished the following description of an extraordinary rainfall at Saint Christopher's Island, British West Indies, in January, 1880: "There was a light rain the evening of the night the downpour took place, but none of consequence before 10 or 11 p. m., and by 5 a. m. the following morning it was all over. There were no rain gauges, but a tank 30 inches deep with vertical sides, such as are used in sugar making, which was known to have been empty before the storm, was filled and running over. The tank was away from any building and it could have received no water save what fell directly from the clouds. The evidence is positive that 30 inches fell, nearly all of it in about 6 hours, and all in 10 or 11 hours, and a low estimate placed the amount at 36 inches. At another estate on the opposite or northerly side of the island, 4 or 5 miles away, and with a mountain some 3,000 feet high intervening, a similar sugar tank, empty the night before, had 23 inches of rainfall the following morning. The little town of Basse Terre, which is built on a nearly flat plain along the sea shore, with a slight upward slope from the water and also sloping in an easterly direction along the shore, with no hill or valley on either side within one-half or